REMARKS

In view of the following remarks, reconsideration of the rejections contained in the Office Action of June 23, 2009 is respectfully requested.

On pages 2-6 of the Office Action, the Examiner rejected claims 1, 2, 9-11, 23 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Hitoshi (JP 2002-226871) in view of Egan (U.S. 3,647,681). On pages 6-9 of the Office Action, the Examiner rejected claims 3-8, 24, 25, 27 and 28 under 35 U.S.C. § 103(a) as being unpatentable over Pilz et al. (U.S. 2002/0113024) in view of Egan. On pages 9-14 of the Office Action, the Examiner rejected claims 12, 13 and 15-22 under 35 U.S.C. § 103(a) as being unpatentable over Pilz in view of Egan and Hitoshi. On pages 14-15 of the Office Action, the Examiner rejected claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Pilz, Egan and Hitoshi, and further in view of Geissbeuhler et al. (US 5,797,989). For the reasons discussed below, it is respectfully submitted that the present claims are clearly patentable over the prior art of record.

Independent claim 1 recites a method of producing sub-critical water decomposition products. The method of claim 1 includes continuously supplying material to be processed into a reactor through an inlet provided for the reactor, whose interior is kept at a sub-critical condition for water. The method of claim 1 also includes *continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor*.

Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure. However, Hitoshi does not disclose a method which includes continuously taking out a liquid containing a decomposition product through any one of <u>a plurality of outlets</u> provided at a different position from a position where the inlet of the reactor is provided, as required by independent claim 1, because Fig. 1 of Hitoshi only discloses the reactor 1 as having a <u>single</u> outlet.

Further, it is noted that Hitoshi does not disclose a method which includes <u>continuously taking out a liquid</u> containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, <u>to adjust residence time of the liquid containing the decomposition product in the reactor</u>, as required by independent claim 1. Rather, paragraph [0024] of Hitoshi discloses that the holding

time is controlled by controlling the speed at which the high-pressure, high-temperature water is supplied to the reactor.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities. It is also noted that distillation is a physical separation process, and not a chemical reaction. Thus, it is noted that the separation zone 5 having the multiple outlets is not a reactor, because the components are separated in the separation zone 5 by a physical separation process, and not by a reaction. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating (which is not a reaction) to remove selected decomposition products, as asserted by the Examiner.

Further, Egan also does not disclose or suggest continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor, as required by independent claim 1.

Accordingly, as none of the Hitoshi and Egan references discloses a method which includes continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, to adjust residence time of the liquid containing the decomposition product in the reactor, as required by independent claim 1, it is respectfully submitted that the combination of the Hitoshi and Egan references does not disclose or suggest the method of independent claim 1.

Independent claim 2 recites a method of producing sub-critical water decomposition products. The method of claim 2 includes continuously supplying material to be processed into a reactor through an inlet provided for the reactor, whose interior is kept at a sub-critical condition for water, and *continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the*

reactor is provided, to form desired steady concentration profiles of the decomposition product in the reactor. The method of claim 2 also includes taking out the desired decomposition product through at least one of the outlets, the at least one of the outlets being provided at a position where the concentration of the desired decomposition product is high.

As discussed above, Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure, but does not disclose a method which includes continuously taking out a liquid containing a decomposition product through any one of <u>a plurality of outlets</u> provided at a different position from a position where the inlet of the reactor is provided, as required by independent claim 2, because Fig. 1 of Hitoshi only discloses the reactor 1 as having a <u>single</u> outlet.

In addition, Hitoshi does not disclose continuously taking out a liquid containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, <u>to form desired steady concentration profiles of the decomposition product in the reactor</u>, as required by independent claim 2.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, as indicated above, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities, and that distillation is a <u>physical separation process, and not a chemical reaction</u>. Thus, it is noted that the separation zone 5 having the multiple outlets <u>is not a reactor,</u> because the components are separated in the separation zone 5 by a <u>physical</u> separation process, and not by a <u>reaction</u>. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the <u>reactor of Hitoshi</u> in order to use <u>fractionating (which is not a reaction)</u> to remove selected decomposition products, as asserted by the Examiner.

Further, Egan also does not disclose or suggest <u>continuously taking out a liquid</u> containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, <u>to form desired steady concentration profiles of the decomposition product in the reactor</u>, as required by independent claim 2.

Accordingly, as <u>none</u> of the Hitoshi and Egan references discloses a method which includes <u>continuously taking out a liquid</u> containing a decomposition product through any one of a plurality of outlets provided at a different position from a position where the inlet of the reactor is provided, <u>to form desired steady concentration profiles of the decomposition product in the reactor</u>, as required by independent claim 2, it is respectfully submitted that the combination of the Hitoshi and Egan references does not disclose or suggest the method of independent claim 2.

Independent claim 3 recites a method of producing sub-critical water decomposition products. The method of claim 3 includes continuously supplying material to be processed that contains solid matter having a slow decomposition rate with sub-critical water and a different specific gravity from that of the sub-critical water, into a vertical-type reactor whose interior is kept at sub-critical conditions for water, through an inlet provided for the reactor. The method of claim 3 also includes *selecting an outlet from which a liquid containing a decomposition product is let out and adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor*, with the steady flow flowing in an opposite direction to a direction in which the solid matter sinks or floats up and being slower than a sinking velocity or floating velocity of the solid matter.

The method of claim 3 also includes forming in the steady flow, in the following order from upstream of the flow, at least a fluidized bed in which the solid matter is decomposed into fine particles by the sub-critical water and the fine particles fluidize in the flow, and a sub-critical water dissolution part in which the material to be processed is turned into further finer particles or completely turned into a soluble material to flow with the sub-critical water, and further forming, depending on a type of the material to be processed, a fixed bed in which solid matter stays in a fixed location even with the flow, with the fixed bed being formed upstream of the fluidized bed. Claim 3 also recites taking out the liquid containing a desired decomposition product from the sub-critical water dissolution part from the reactor, using at least one of the outlets.

Pilz discloses a method for supercritical wet oxidation which, as shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. Pilz also discloses that the vessel 2 includes an outlet 24 for

the removal of solids, a vertical separation wall 26 and a horizontal separation wall 28.

However, Pilz does not disclose a method which includes selecting an outlet from which a liquid containing a decomposition product is let out and adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor, as required by independent claim 3.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products. (It is noted that page 7 of the Office Action indicates that it would have been obvious to combine the multiple outlets on the reactor of Hitoshi. However, as the Hitoshi reference is not mentioned in the rejection of claim 3, it is presumed that the Examiner intended to state the "reactor of Pilz").

However, as indicated above, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities, and that distillation is a physical separation process, and not a chemical reaction. Thus, it is noted that the separation zone 5 having the multiple outlets is not a reactor, because the components are separated in the separation zone 5 by a physical separation process, and not by a reaction. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating (which is not a reaction) to remove selected decomposition products, as asserted by the Examiner.

In this regard, it is noted that MPEP § 2143.01(VI) states that if a "proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." As indicated above, Pilz discloses a method for supercritical wet oxidation (*i.e.*, a chemical reaction), while Egan discloses a method which includes fractionating (*i.e.*, a physical separation process, and not a chemical reaction). Thus, modifying the device of Pilz by providing multiple outlets on the reactor of Pilz "in order to use fractionating to remove selected decomposition products," as asserted by the Examiner, would change the principle of operation of the device of Pilz from supercritical wet oxidation (*i.e.*, a chemical reaction) to fractionating (*i.e.*, a physical separation process, and not a chemical reaction), and therefore the teachings of

the Pilz and Egan references are insufficient to render independent claim 3 *prima facie* obvious.

Further, Egan also does not disclose a method which includes selecting an outlet from which a liquid containing a decomposition product is let out and <u>adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state</u> with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor, as required by independent claim 3.

Accordingly, as none of the Pilz and Egan references discloses a method which includes selecting an outlet from which a liquid containing a decomposition product is let out and <u>adjusting an outlet amount thereof, to make a steady flow in the sub-critical water in a steady state</u> with a plurality of outlets provided at a position different in height from where the inlet is provided for the reactor, as required by independent claim 3, it is respectfully submitted that the combination of the Pilz and Egan references does not disclose or suggest the method of independent claim 3.

Independent claim 4 recites a method of producing sub-critical water decomposition products. The method of claim 4 includes supplying a mixture including an object containing solid matter and subcritical water into a reaction container through a same inlet and causing the mixture to flow in sub-critical water in a steady state in an opposite direction to a direction in which the solid matter flows. The method of claim 4 also includes forming in the flow, in the following order from upstream of the flow, at least a fluidized bed in which the solid matter is decomposed into fine particles by the sub-critical water and the fine particles fluidize in the flow, and a sub-critical water dissolution part in which the material to be processed is turned into further finer particles or completely turned into a soluble material to flow with the sub-critical water. Further, the method of claim 4 includes further forming, depending on a type of the material to be processed, a fixed bed in which solid matter stays in a fixed location even with the flow, the fixed bed being formed upstream of the fluidized bed, and *adjusting a distance through which the sub-critical water dissolution part flows to vary a residence time of the solid matter and a residence time of the sub-critical water from each other* and to adjust a degree of decomposition of the components of the material to be processed that have been made soluble to the sub-critical water, whereby a target decomposition treatment product is obtained.

As indicated above, Pilz discloses a method for supercritical wet oxidation which, as

shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. However, Pilz does not disclose *adjusting a distance through which the sub-critical water dissolution part flows to vary a residence time of the solid matter and a residence time of the sub-critical water from each other*, as required by independent claim 4.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products.

However, as indicated above, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities, and that distillation is a <u>physical separation process, and not a chemical reaction</u>. Thus, it is noted that the separation zone 5 having the multiple outlets <u>is not a reactor,</u> because the components are separated in the separation zone 5 by a <u>physical</u> separation process, and not by a <u>reaction</u>. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the <u>reactor of Pilz</u> in order to use <u>fractionating (which is not a reaction)</u> to remove selected decomposition products, as asserted by the Examiner.

In this regard, it is noted that MPEP § 2143.01(VI) states that if a "proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." As indicated above, Pilz discloses a method for <u>supercritical wet oxidation</u> (*i.e.*, <u>a chemical reaction</u>), while Egan discloses a method which includes fractionating (*i.e.*, a <u>physical separation process, and not a chemical reaction</u>). Thus, modifying the device of Pilz by providing multiple outlets on the reactor of Pilz "in order to use fractionating to remove selected decomposition products," as asserted by the Examiner, would <u>change the principle of operation</u> of the device of Pilz from supercritical wet oxidation (*i.e.*, a chemical reaction) to fractionating (*i.e.*, a physical separation process, and not a chemical reaction), and therefore the teachings of the Pilz and Egan references are insufficient to render independent claim 4 *prima facie* obvious.

Accordingly, as none of the Pilz and Egan references discloses a method which includes adjusting a distance through which the sub-critical water dissolution part flows to vary a residence time of the solid matter and a residence time of the sub-critical water from each other,

as required by independent claim 4, it is respectfully submitted that the combination of the Pilz and Egan references does not disclose or suggest the method of independent claim 4.

Independent claim 11 recites an apparatus for sub-critical water decomposition treatment, comprising a reactor configured to decompose material to be processed using sub-critical water, heating means for heating a mixture composed of water and the to be processed material to form and keep sub-critical conditions for water, and compressing means for compressing the mixture. Further, claim 11 recites introducing means for introducing the material to be processed into the reactor, an inlet through which the material to be processed is to be introduced into the reactor, and an outlet for letting out a mixture of a decomposition product and water from the reactor, wherein the outlet is provided at at least one of a plurality of positions different from a position where the inlet is provided, so that the outlet can take up a plurality of positions.

Hitoshi discloses a gasification reactor which decomposes plastics at high temperature and high pressure. However, as acknowledged by the Examiner on page 9 of the Office Action, Hitoshi does not disclose an outlet for letting out a mixture of a decomposition product and water from the reactor, wherein the outlet is provided at <u>at least one of a plurality of positions different from a position where the inlet is provided, so that the outlet can take up a plurality of positions</u>, as required by independent claim 11.

In this regard, the Examiner cites Egan as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Hitoshi in order to use fractionating to remove selected decomposition products.

However, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities. It is also noted that distillation is a <u>physical separation process, and not a chemical reaction</u>. Thus, it is noted that the separation zone 5 having the multiple outlets <u>is not a reactor,</u> because the components are separated in the separation zone 5 by a <u>physical</u> separation process, and not by a <u>reaction</u>. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the <u>reactor of Hitoshi</u> in order to use <u>fractionating (which is not a reaction)</u> to remove selected decomposition products, as asserted by the Examiner.

Independent claim 12 recites an apparatus for sub-critical water decomposition treatment, which includes a vertical-type reactor configured to decompose material to be processed with sub-critical water, heating means for heating a mixture of water and the material to be processed and compressing means for compressing the mixture, so as to form and keep a sub-critical condition for water, and introducing means for introducing the material to be processed into the reactor. Further, claim 12 recites an inlet through which the material to be processed is to be introduced into the reactor, and an outlet for letting out a mixture of water and a decomposition product from the reactor.

In addition, claim 12 recites that the reactor is arranged substantially vertically, the inlet is provided for at least one of a top end portion or a bottom end portion of the reactor, and that the introduced mixture of the material to be processed and the sub-critical water is caused to flow, in the sub-critical water in a steady state, in an opposite direction to a direction in which the solid matter travels, so as to form in the flow, in the following order from upstream of the flow, at least a fluidized bed in which the solid matter is decomposed into fine particles with the sub-critical water and the fine particles fluidize in the flow, and a sub-critical water dissolution part in which the material to be processed is turned into further finer particles or completely into a soluble material to flow with the sub-critical water, and to further form, depending on the material to be processed, a fixed bed in which solid matter stays in a fixed position even with the flow, the fixed bed being formed upstream of the fluidized bed. Further, claim 12 recites that *a position of the outlet is adjustable so as to let out the sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows*.

Pilz discloses a method for supercritical wet oxidation which, as shown in Fig. 5, includes supplying supercritical water to a vessel 2 through a conduit 4, and introducing solids into the vessel 2 through an inlet 22. However, as indicated by the Examiner on page 11 of the Office Action, Pilz does not disclose a heating and pressurizing means, and does not disclose that *a position of the outlet is adjustable so as to let out the sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows*, as required by independent claim 12.

On page 11 of the Office Action, the Examiner cites Hitoshi as disclosing a heating and pressurizing means. However, as indicated above, Hitoshi only discloses the reactor 1 as having a single outlet, and does not disclose that *a position of the outlet is adjustable so as to let out the*

sub-critical water dissolution part and adjust a distance through which the sub-critical water dissolution part flows, as required by independent claim 12.

Further, on page 11 of the Office Action, the Examiner cites Egan as disclosing as disclosing an example of fractionating, in which a chemical reactor having multiple outlets is used. Further, the Examiner asserts that it would have been obvious to one of ordinary skill in the art to provide multiple outlets on the reactor of Pilz in order to use fractionating to remove selected decomposition products.

However, as indicated above, it is noted that fractionating is the distillation of a liquid mixture into its component parts based on the difference in their volatilities, and that distillation is a <u>physical separation process, and not a chemical reaction</u>. Thus, it is noted that the separation zone 5 having the multiple outlets <u>is not a reactor,</u> because the components are separated in the separation zone 5 by a <u>physical</u> separation process, and not by a <u>reaction</u>. Accordingly, it would not have been obvious to one of ordinary skill in the art to provide multiple outlets on the <u>reactor of Pilz</u> in order to use <u>fractionating (which is not a reaction)</u> to remove selected decomposition products, as asserted by the Examiner.

In this regard, it is noted that MPEP § 2143.01(VI) states that if a "proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." As indicated above, Pilz discloses a method for <u>supercritical wet oxidation</u> (*i.e.*, <u>a chemical reaction</u>), while Egan discloses a method which includes fractionating (*i.e.*, a <u>physical separation process, and not a chemical reaction</u>). Thus, modifying the device of Pilz by providing multiple outlets on the reactor of Pilz "in order to use fractionating to remove selected decomposition products," as asserted by the Examiner, would <u>change the principle of operation</u> of the device of Pilz from supercritical wet oxidation (*i.e.*, a chemical reaction) to fractionating (*i.e.*, a physical separation process, and not a chemical reaction), and therefore the teachings of the Pilz and Egan references are insufficient to render independent claim 12 *prima facie* obvious.

Therefore, it is respectfully submitted that independent claims 1-4, 11 and 12, as well as claims 5-10 and 13-28 which depend therefrom, are clearly allowable over the prior art of record.

In view of the foregoing remarks, it is respectfully submitted that the present application is clearly in condition for allowance. An early notice to that effect is respectfully solicited.

If, after reviewing this response, the Examiner feels there are any issues remaining which must be resolved before the application can be passed to issue, the Examiner is respectfully requested to contact the undersigned by telephone in order to resolve such issues.

Respectfully submitted,

Hiroyuki YOSHIDA

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